The Best of Both Worlds: CAD and GIS at the University of Washington

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From Old to New
The needs for GIS floor plans are varied and many. The University of Washington (UW) had a process to use GIS floor plans for space management that had worked well for many years. As the inventory of space grew over time, the manual processes for converting the CAD floor plans to GIS consumed too much valuable time. In 2008, UW began a project to revise the system and improve the efficiency of the process. The goal was to reduce the dozen or more manual steps to fewer than three. In the end, the process ended up being entirely automated, with no manual steps for translation at all.

Esri was selected at the outset of the project based on its position as the world leader in GIS as well as its database architecture and available tools. A combination of Esri software was used, including ArcSDE technology for storage, ArcGIS for Server for web services, and ArcGIS for Desktop for map publishing. While GIS was the driver for the project, it was not the only consideration. Paramount was the need to continue maintaining the CAD floor plans and the specific requirements for the way the CAD drawings were prepared. One of the most challenging aspects was to create a solution that would resolve a serious conflict of requirements between CAD and GIS: georeferencing. The need for georeferenced floor plans was identified as an important requirement at the outset of the project even though the previous system did not use georeferenced data. At the same time, the CAD requirements would not allow moving the origin of the drawing or rotating the building. The solution was to use a single world file per building that would allow for automatic georeferencing during the translation process.

While there were already a few different methods for translating CAD floor plans to GIS, none fully met UW’s needs. Most processes were designed entirely from a GIS perspective and did not address the complete workflow. UW’s solution is designed from a CAD user perspective for maintenance but results in a GIS output that is much more flexible than CAD could ever be.

Standards, Standards, Standards
Did I mention standards? It turns out standards are important. More time and money for the project was spent on the standardization and cleanup of the CAD drawings than anything else. By defining a good set of CAD standards and, more importantly, enforcing them, the process of writing code to perform automation could be accomplished. While trying to write...
Reports can be created from the information that is stored in ArcGIS. ArcGIS provides an easy-to-access overview of all capital projects with the ability to open up the CAD files associated with each project.

Some automation code, the unpredictable nature of the source data (CAD) turned out to be too complex to be worth the effort. By standardizing, the custom code was much easier to write.

What about BIM?
When the system was redesigned, building information modeling (BIM) was not part of the picture. Since then, some models have been incorporated into the inventory but are not fully automated yet. The current process requires exporting the “sheets” to CAD, which completely overrides the existing CAD drawing. The process with BIM now requires a couple of manual processes, but the efficiencies of updating in BIM more than make up for it.

So How Does It Work?
Unfortunately, it’s impossible to describe all the nuts and bolts of what it takes to make a system like this work in a short article, but the key to the entire process is ArcGIS for AutoCAD. ArcGIS for AutoCAD provides the functionality to create GIS feature classes within the CAD drawing itself. The end result is that the translation is not a CAD to GIS translation but actually a feature class to feature class translation. It also means that it doesn’t matter which “flavor” of AutoCAD is used. The GIS feature class schema from ArcSDE is replicated in CAD, which makes the translation simple. The translation itself is a combination of a Python script and Safe Software’s FME. The whole process runs every hour and is able to identify any floor plans that have changed since the last run and only processes those drawings that have changed.

Using GIS Floor Plans: The New “Basemap”
The core need for the UW GIS floor plan system is the space management system, but by leveraging that initial investment and combining it with a couple other pieces of technology, UW is taking GIS floor plans to a whole new level.

One of the capabilities that has become very important for using GIS floor plans is the Data Driven Pages system released with version 10.0 and enhanced at ArcGIS 10.1. One of the major differences between traditional GIS and GIS for interior building space is that the floor plan itself becomes the basemap that all other data uses for context. Moreover, without filtering the data by building and/or floor, it is impossible to make any sense of the data. The Data Driven Pages system provides an excellent framework for addressing the filtering problem. Another crucial component
Georeferencing campus data means that GIS analysis can be used to provide more efficient planning around the large facility.

Campus routing is available inside and outside buildings.

ArcGIS for AutoCAD allows CAD operators to work within the environment they are familiar with.

is the Attribute Assistant found in the Campus Editing template. By combining Data Driven Pages with Attribute Assistant, managing floor plan-based datasets is a breeze.

So . . . GIS or CAD?
Is it too much to ask for both? By creating a fully automated process for integrating CAD floor plans with GIS, UW has been able to realize the best of both worlds. Depending on the situation, the appropriate format is selected, but the data is exactly the same in both platforms.

With the core infrastructure now in place, UW is exploring many avenues for making floor plan-based systems more efficient and even looking at processes that were never cost-effective to do before. Some of these include interior building navigation, interior utilities management, asset management linked to computerized maintenance management systems (CMMS), and emergency evacuation mapping, and there are many more.

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